SEMESTER EXAMINATION DECEMBER-2024

Course Name: - B. TECH(CS) **Semester: - 5**

Paper Name: - Formal Language & Automata Theory **Paper Code: - TCS-505**

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. **Max Marks-70**

समय– 3 घण्टे + 20 मिनट प्रति घंटे अतिरिक्त–दृष्टिबाधित एवं सह लेखक परीक्षार्थियों के लिए। अधिकतम अंक–70

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries **3 mark. All questions are compulsory.**
- Section B- Answer any **5 out of 7** given questions. Each question carries **7 marks.**
- Section C- Answer any **2 out of 3** given questions. Each question carries **10 marks.**
- Section D- Each question carries **2 mark. All questions are compulsory.**

निर्देश:

- प्रश्न पत्र में तीन खण्ड अ, ब, व स हैं। सभी खण्ड अनिवार्य हैं।
- खण्ड–अ में प्रत्येक प्रश्न **तीन अंक** का है। **सभी प्रश्न अनिवार्य हैं।**
- खण्ड–ब में **सात प्रश्नों में से किन्हीं पाँच** प्रश्नों के उत्तर दें। प्रत्येक प्रश्न **सात अंक** का है।
- खण्ड–स में **तीन प्रश्नों में से किन्हीं दो** प्रश्नों के उत्तर दें। प्रत्येक प्रश्न **10 अंक** का है।
- खण्ड–द में प्रत्येक प्रश्न **दो अंक** का है। **सभी प्रश्न अनिवार्य हैं।**

Section – A (खण्ड–अ)

Objective Questions (वस्तुनिष्ठ प्रश्न)

1. Answer all the following questions. 5x3 =15

निम्नलिखित सभी प्रश्न अनिवार्य हैं।

i) Ø in minimal finite automata need _____ no. of final states

a) 1

b) 2

c) 3

d) None

ii) CFL are not closed under Intersection and Complementation

a) True

b) False

c) maybe

d) none of these

iii) The push down automata accept the input string in form of

a) Final state

b) Empty stack

c) Both a and b

d) None of these

iv) Which of the following pairs have different expressive power?

a) DFA and NFA

b) DPDA and NPDA

c) Deterministic single tape TM and Non deterministic single tape TM

d) single tape TM vs multi-tape TM

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v) A Turing machine with several tapes in known as:

a) Multi-tape Turing machine

b) Universal Turing machine

c) Poly-tape Turing machine

d) None of these

Section – B (खण्ड–ब)

Short Answer Questions (लघुउत्तरीय प्रश्न)

2. Answer any five of the following questions. 5x7=35

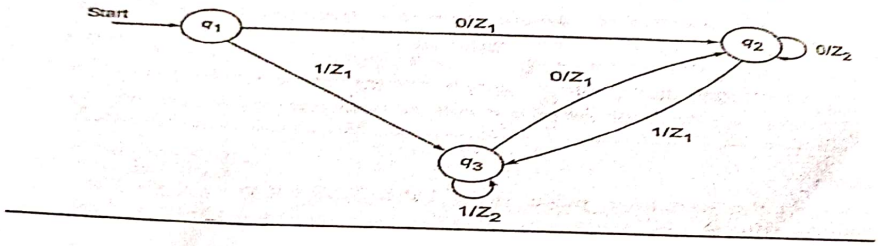
निम्नलिखित में से किन्हीं पाँच प्रश्नों के उत्तर दें।

i. Prove that the following Language L = {$a^n b^n$: n>=0} is not a regular language.

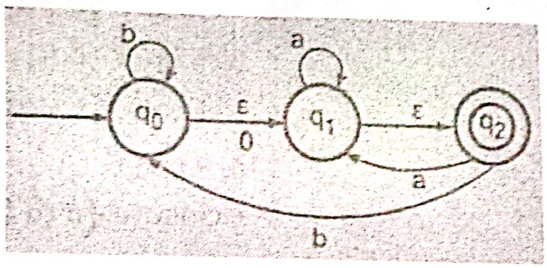
ii. Design the DFA that accepts an even number of a's and even number of b's.

iii. State and prove Arden's theorem for regular expression.

iv. Construct a Moore machine equivalent to the given mealy machine



v. Convert the NFA with epsilon to NFA without epsilon



vi. Find a grammar in CNF equivalent to the grammar

S→ aAbB, A →aA/a, B→bB/b

vii. Consider the following productions:

S→ aB / bA, A→ aS / bAA / a , B→ bS / aBB / b

For the string aaabbabbba find

a) leftmost derivation b) rightmost derivation

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Section – C (खण्ड–स)

Descriptive Questions (विवरणात्मक प्रश्न)

3. **Answer any two of the following questions.** 2x10=20
निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर दें।

i) Construct a DFA with reduced state equivalent to the regular expression $(1+0)^*(11+00)(1+0)^*$

ii) Design a Turing machine for the language $L=\{a^n b^n c^n / n\geq 1\}$

iii) Define regular expression and write all identities of regular expression.

Section – D (खण्ड– द)

Answer all of the following questions [10x2=20]

Objective Questions (वस्तुनिष्ठ प्रश्न)

Q1 Which of the following conversion is not feasible?
(a) Regular expression to automaton conversion
(b) Automaton to Regular Expression Conversion
(c) NFA to DFA
(d) None of the mentioned

Q2 While applying Pumping lemma over a language, we consider a string x that belong to L and fragment it into _____ parts.
(a) 2
(b) 5
(c) 3
(d) 6

Q3 What is the relation between DFA and NFA on the basis of computational power?
(a) DFA > NFA
(b) NFA > DFA
(c) Equal
(d) Can't be said

Q4 Which of the following conversion is not feasible?
(a) Regular expression to automaton conversion
(b) Automaton to Regular Expression Conversion
(c) NFA to DFA
(d) None of the mentioned

Q5 The major difference between Mealy and Moore machine is about:
(a) Input Variations
(b) Output Variations
(c) Both
(d) None of the mentioned

Q6 NFA is not closed under:
(a) Union
(b) Intersection
(c) Concatenation
(d) None of the mentioned

Q7 Given the language L = {ab, aa, baa}, which of the following strings are in L*?
(a) abaabaaabaa
(b) aaaabaaaa
(c) baaaaabaa
(d) All of these

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Q8 The symbol Z_0 in formal definition of PDA is used for
(a) Input symbol
(b) Initial Stack symbol
(c) Unprocessed input
(d) Transition function

Q9 Limitation of PDA can overcome by:
(a) Mealy machine
(b) Moore machine
(c) Turing machine
(d) FA

Q10 If L1 and L2 are two context free languages, then which one is true?
(a) L1 ∪ L2 is context free
(b) L1.L2 is context free
(c) Kleene closure L1* is context free
(d) All of these

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